

SPECIFICATION AMENDMENTS

Amend the paragraphs that begin in line 13 on page 4 as follows:

According to this invention, a voltage-impressed current measuring apparatus which impresses a prescribed voltage and measures the current flowing to a load apparatus, is configured so as to comprise

a current-range switching portion having: a plurality of pairs connecting in series a plurality of current buffers with switches, ~~[the buffers]~~ the buffers having output stages capable of being electrically connected or disconnected in response to a supplied control signal, and current measurement resistances of differing resistance values respectively connected to the output stages of the current buffers with switches, wherein any one of the pairs is selected by a control signal to switch the current measurement range, said output stage of the current buffer with switch of said selected pair taken to be in a connected state;

a direct-current power supply portion, supplying a prescribed direct-current voltage to said load apparatus through the series connection of the current buffer with switch and current measurement resistance selected by said current range switching means; and

a potential difference measuring means, measuring, as a value corresponding to the current flowing in said load apparatus, the potential difference across the two ends of the current measurement resistance of said series connection due to the current which accompanies the impression of said direct-current voltage on said load apparatus and flows from the current buffer with switch of said selected series connection to said load apparatus.

According to this invention, the current buffers with switches ~~[each]~~ each have a pre-stage portion and an output stage,

wherein said output stages have complementary first and second transistors which have their emitters mutually connected, the voltage of the same connection point taken to be the output voltage of said current buffers with switches, and their collectors connected respectively to a positive power supply and a negative power supply; and

wherein said pre-stage portions are configured so as to ~~[each]~~ each comprise

Amend the paragraph that begins in line 11 on page 7 as follows:

Below, an embodiment of a voltage-impressed current measuring apparatus according to the present invention will be explained with reference to the figures. Moreover, neither is the scope of

the patent claims limited by the explanation contents of the working mode mentioned hereinafter, nor are the elements, connection relationships, or the like explained with the working mode necessarily required. In addition, the appearance / shape of the elements, connection relationships or the like explained with the working mode is an example and ~~{the invention}~~ the invention is not limited to the same appearance / shape.

Amend the paragraphs that begin in line 1 on page 9 as follows:

The emitters of differential transistors Q1 and Q2 are respectively connected to constant-current source CC3, and their collectors are connected via control level conversion portion 8 to positive power supply VP. Differential transistors Q1 and Q2 mutually become inverted to operate in ON/OFF ~~{states}~~ states by control signals cnt1 and cnt2, and control level conversion portion 8 outputs predetermined OPEN signals C1, C2, C3, C4 on the basis of the pair of the same states.

PNP transistor Q3 has an input voltage Sin (i.e. voltage Va from direct-current power supply portion 220) supplied to its base, its emitter is connected to constant-current source CC1, and its collector is connected to negative power supply VN. Since a fixed current flows in PNP transistor Q3, based on constant-current source CC1, emitter terminal voltage Vb11 becomes higher than input voltage Sin only by the base emitter voltage (approximately 0.6 V), and this ~~{voltage}~~ voltage is supplied to the base input terminal of NPN transistor Q11 as a first base voltage.

In a similar way, NPN transistor Q4 has its base connected to the base of PNP transistor Q3, to which input voltage Sin is supplied. Since a fixed current is flowing, based on constant-current source CC2 connected to the emitter, emitter terminal voltage Vb12 becomes lower than input voltage Sin only by the base emitter voltage (approximately 0.6 V), and this ~~{voltage}~~ voltage is supplied to the base input terminal of PNP transistor Q12 as a second base voltage. The collectors of PNP transistors Q5 and NPN transistor Q6, to whose bases OPEN signals C3, C4 are supplied, are respectively connected to the bases of transistors Q12 and Q11 and control the ON/OFF ~~{operation}~~ operation of transistors Q12, Q11 by OPEN signals C3, C4.

Amend the paragraphs that begin in line 16 on page 10 as follows:

When third OPEN signal C3 becomes valid, PNP transistor Q5 is controlled to be in the ON state, and one ~~{complementary transistor,}~~ complementary transistor PNP transistor Q12 is forcibly biased to the OFF state. As a result of this, output voltage Vout can be supplied with high

impedance, whatever the voltage range, from positive power supply VP to negative power supply NP ~~[VN?] VN~~, and an open state can be maintained.

When fourth OPEN signal C4 becomes valid, NPN transistor Q6 is controlled to be in the ON state, and the other ~~[complementary transistor,] complementary transistor~~ NPN transistor Q11 is forcibly biased to the OFF state. As a result of this, output voltage Vout can be supplied with high impedance, whatever the voltage range, from positive power supply VP to negative power supply VN, and an open state can be maintained.

Amend the paragraph that begins in line 27 on page 11 as follows:

Consequently, it is possible to configure range switching portion 210 shown in Fig. 3 by applying the aforementioned current buffer with switch CB1 of Fig. 4. Because of this, by making the DUT load current flow to a desired series resistance R1 to Rn using external control signals cnt1 to cntn, it becomes possible to measure the current for each range by supplying two voltage signals, of ~~output [input?] input~~ side voltage Va (detected voltage Vc) and load side voltage Vb (detected voltage Vd) which are detected based on said series resistance, to potential difference measuring portion 150. In this way, one can, for current buffers with switches CB1 to CBn, make a configuration with transistors, since the same circuit configuration elements are elements which can be made into IC or MCM, so a substantial miniaturization can be implemented. In addition, because the settling time of the ON/OFF control is less than several μ s, the advantage can also be obtained that it becomes possible to switch with a remarkably high speed, compared to the past. Also, there is the advantage that, as regards the drive current required for the ON/OFF control, very little is sufficient.

Amend the paragraph that begins in line 4 on page 13 as follows:

Multiple-contact switch 20 receives the voltage signals of one end of each series resistance R1 to Rn and, based on control signals cnt1 to cntn, selectively switches to and outputs one ~~[of the signals] of the signals~~. A multiple-contact switch 20 such as this can be configured with transistor circuits which can be designed into an IC.

Amend the paragraph that begins in line 22 on page 13 as follows:

Current buffers with switches CB31 to CB3n are switches transmitting voltage signals, which basically have one and the same internal configuration as the aforementioned current buffer

with switch CB1 in Fig. 5. However, since potential difference measuring portion 150 receives with high impedance, there is no need for current buffering, so it is acceptable to have only transmission of the voltage signal. Accordingly, they are not a main cause of voltage drop errors like ~~those caused by~~ those caused by the aforementioned current buffers with switches CB1 to CBn.

Amend the paragraph that begins in line 3 on page 15 as follows:

Moreover, in the aforementioned configuration example in Fig. 3, the explanation was given with an embodiment using current buffers with switches CB1 to CBn, but range switching portion 210 shown in Fig. 8 may be used as desired. The current range switching portion 210 in Fig. 8 is composed of feedback operational amplifiers A31 to A3n, current buffers with switches CB1 to CBn connected to the outputs of the same, and series resistances R1 to Rn connected to the outputs of the same current buffers CB1 to CBn. The output of each current buffer with switch CBi is fed back to the inverted input of the corresponding feedback operational amplifier A3i. However, for the terminals of feedback operational amplifiers A31 to A3n, elements ~~[measuring]~~ measuring at high impedance and not interfering with the measurements are applied. In this case, as a result of the output voltages Va1 to Van of the output terminal of each current buffer with switch CB1 to CBn being feedback controlled by feedback operational amplifiers A31 to A3n so as to match the input and output voltage Va, the advantage is obtained that the individual output voltage error causes of current buffers with switches CB1 to CBn can be cancelled.

Amend the abstract that begins in line 3 on page 23 as follows:

A voltage-impressed current measuring apparatus, wherein the voltage from a direct-current power supply portion (~~220~~) is impressed on the terminal of a device under test (~~DUT~~) via a range switching portion (~~210~~) and the current flowing in the same terminal is measured; wherein the range switching portion (~~210~~) has a plurality of current buffers with switches (~~CB1 to CBn~~) corresponding to current measurement ranges, and a plurality of current measurement resistances (~~R1 to Rn~~) respectively connected in series to the output sides of the same; and wherein the current flowing in the terminal of the device under test is measured by measuring the voltage across both ends of the current measurement resistance of the selected series connection, by a voltage difference measuring portion (~~150~~). Each current buffer with switch (~~CBi~~) has an output stage (~~12~~) capable of connection / disconnection in response to a control signal.